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The Limb of the Martian Atmosphere in Mars Express' High Resolution Stereo Camera Images

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The Martian atmosphere often shows horizontal layers of haze up to altitudes of about 80 km. The High Resolution Stereo Camera, HRSC (Neukum et al. 2004; Jaumann et al. 2007) has been used to sample the planetary limb. HRSC is a push broom scanner with nine line sensors pointing in different directions to facilitate stereoscopic imaging. Four of the sensors have colour filters at 440 nm, 530 nm, 750 nm and 970 nm, respectively. The five other sensors all have filters centred at 650 nm. These panchromatic filters have a much wider bandpass than the four colour filters. It is not possible to obtain and compare profiles at the same location and at the same time with different sensors, but still, averages of profiles over place and season can provide us with information about typical atmospheric conditions. We examine the HRSC planetary limb data and analyse the seasonal and latitudinal variations of the maximum altitude of the haze layer and of the occurrence of high altitude detached hazes. Most observations were made with the panchromatic channels. There are also many observations with the blue and green sensors and only a few were made in the red and infra red channels. We find the best data coverage in northern spring in the northern most latitudes. For obvious reasons, we do not have any data during polar nights.
The colour observations show on average variations of aerosol composition with latitude and altitude. We make some comparisons with earlier work, i.e. from the Viking Orbiter and Mars Express SPICAM experiments. In contrast to the SPICAM instrument, which is used for night time stellar occultation measurements by Montmessin et al., HRSC observes the atmosphere during daytime, which makes it possible to compare night and daytime observations. The seasonal variations of maximum altitude of the aerosols is in good agreement with Jaquin et al. (1986) and with Montmessin et al. (2006). The similarity between Montmessin's results and ours is likely to be due to the large annual variation of atmospheric dust load compared to the diurnal cycle.